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Addressing slow drift effects in the SASE3 Soft X-ray Beamline at the European XFEL: performance of an autocollimator-based correction method

The SASE3 soft X-ray beamline at the European XFEL is equipped with a 100-meter-long-arm monochromator, which delivers to the experiments (SQS, SCS, SXP) pink or monochromatic beam in the photon energy range of 250 eV - 3000 eV. Due to the considerable length of the arm, ensuring stability becomes crucial in the short and long timescale. Currently, the system does not have cooling installed, primarily due to the complexity of that installation and the challenges associated with fabricating the long grating.

The absence of cooling is triggering a slow drift of the system, which is not entirely captured by the encoders and therefore cannot be corrected. Consequently, this drift results in an undesired drift of the photon energy of the delivered monochromatic beam, causing challenges for high-precision experiments. The effect becomes more pronounced when using multiple pulses and high pulse energies, due to the higher heat load.

To address this issue, we have installed an autocollimator that directly observes the grating position from outside the chamber, providing an independent measurement of the drift. In this presentation, we will discuss the performance of this system, present the results obtained from experiments, and outline potential future improvements. While the proposed method offers a straightforward solution for on-site correction of these drifts, it is important to acknowledge certain limitations that need to be taken into account.

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yes

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